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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,644	08/19/2003	Songting Chen	ARC920030030US1	5236

7590 02/27/2006

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EXAMINER	
SAEED, USMAAN	
ART UNIT	**PAPER NUMBER**
2166	

DATE MAILED: 02/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/643,644	CHEN ET AL.	
	Examiner	Art Unit	
	Usmaan Saeed	2166	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 19 August 2003.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-27 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-27 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 08/19/2003.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-27 are rejected in this office action.

Information Disclosure Statement

2. Applicants' Information Disclosure Statement, filed on 08/19/2003 has been received, entered and considered. See attached form PTO-1449.

The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Specification

3. The attempt to incorporate subject matter into this application by reference to U.S. Patent Application No. 09/453,892 is ineffective because it is not titled as "Incremental Maintenance of Summary Tables with Complex Grouping Expressions" as given in "cross reference to related applications" section in the specification.

Applicant is also advised to delete the attorney docket number from the "cross reference to related applications" section because it is confidential information and shouldn't be published.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-2, 4, 8-9, 11, 15-16, 21-22 and 24 are rejected under 35 U.S.C. 102(a) as being anticipated by **Palpanas et al**. (**Palpanas** hereinafter) (NPL "Incremental Maintenance for Non-Distributive Aggregate Functions, Proceedings of the 28th VLDB conference, Hong Kong. China, 2002, 12 pages").

With respect to claim 1, **Palpanas** teaches **"a method of incrementally maintaining algebraic functions in automatic summary tables (ASTs) of at least one relational database, said method comprising"** as the incremental infrastructure with work areas to support the maintenance of functions that are algebraic (**Palpanas** Abstract). Materialized views, or Automatic Summary Tables (ASTs), are increasingly

being used to facilitate the analysis of the large amounts of data being collected in relational databases (**Palpanas** Introduction).

"associating a work area with each algebraic function in each AST" as a function is algebraic for an operation if the new result of the function, as a result of the operation, can be computed using some small, constant size storage (work area) that accompanies the existing value of the aggregate (**Palpanas** 1.1 Classes of Aggregate Functions).

"populating variables within each work area for each algebraic function when each AST is created and when each AST is updated" as when an update is required, expressions are built in the result of the join to compute the new values of the affected aggregate functions by combining the old values from the AST with the corresponding values of the final delta (**Palpanas** 2.2.2 Apply Phase Compilation). The maintenance of algebraic functions is optimized by incrementally maintaining the information in the work area and computing the resulting aggregate function of the query from the work area. Some standard SQL functions that are algebraic are AVG, CORRELATION, COVARIANCE, the REGRESSION functions, STDDEV and VARIANCE (**Palpanas** 4 Using Work Areas). AVG and STDDEV are algebraic for INSERT and DELETE. For AVG, the work area consists of simply the COUNT (**Palpanas** 1.1 Classes of Aggregate Functions).

"maintaining each work area by adding and subtracting to and from associated variables of each work area" as the system can compute the new value of the aggregate function from its old value and the changes themselves, for both

insertions and deletions (**Palpanas** 1.1 Classes of Aggregate Functions). Examiner interprets insert as adding and delete as subtracting. **"when associated data changes in said relational database"** as the apply phase detects that only updates are in the data flow, and consequently builds clauses that update only those aggregate functions of the AST which are affected by the changes to the underlying tables (**Palpanas** 3.5 Eliminate Unnecessary Operations).

"computing each algebraic function" as a function is algebraic for an operation if the new result of the function, as a result of the operation, can be computed using some small, constant size storage (work area) that accompanies the existing value of the aggregate (**Palpanas** 1.1 Classes of Aggregate Functions).

Claim 21 is essentially the same as claim 1 except it sets forth the claimed invention as a computer program, and is rejected for the same reasons as applied hereinabove.

With respect to claim 2, **Palpanas** teaches **"the method in claim 1, wherein multiple algebraic functions share the same work area"** as the work areas from each partition are then combined into a final work area, and the aggregate function is computed from the final work area. We apply the same algorithms to incrementally maintain these functions for insertions, and similar algorithms can also be used for deletions. The final work area for each of these functions must be kept in the

materialized view as an additional, hidden attribute (**Palpanas** 4 Using Work Areas). The examiner interprets the final work area as shared area.

Claims 9, 16 and 22 are same as claim 2, except claim 22 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

With respect to claim 4, **Palpanas** teaches **"the method in claim 1, wherein said computing process comprises recomputing said algebraic function after one or more of said variables have changed"** as only the function STDDEV (salary) will be recomputed, since the specified changes do not affect the other aggregate functions (**Palpanas** 3.5Eliminate Unnecessary Operations, Example 3). Recomputation is being done after changes made to salary.

Claims 11 and 24 are same as claim 4, except claim 24 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

With respect to claim 8, **Palpanas** teaches **"a method of updating an automatic summary table (AST), wherein said AST stores derived data from multiple dynamic data tables and said AST comprises multiple algebraic functions, said method comprising"** as the incremental infrastructure with work areas

to support the maintenance of functions that are algebraic (**Palpanas** Abstract). Materialized views, or Automatic Summary Tables (ASTs), are increasingly being used to facilitate the analysis of the large amounts of data being collected in relational databases (**Palpanas** Introduction). The apply phase detects that only updates are in the data flow, and consequently builds clauses that update only those aggregate functions of the AST which are affected by the changes to the underlying tables (**Palpanas** 3.5 Eliminate Unnecessary Operations).

"creating a separate work area for each algebraic function within said AST" as queries containing the aforementioned function can be evaluated in parallel using work areas (**Palpanas** 4 Using Work Areas).

"maintaining each work area by adding and subtracting to and from associated variables of each work area" as the system can compute the new value of the aggregate function from its old value and the changes themselves, for both insertions and deletions (**Palpanas** 1.1 Classes of Aggregate Functions). Examiner interprets insert as adding and delete as subtracting. **"when associated data changes in said relational database"** as the apply phase detects that only updates are in the data flow, and consequently builds clauses that update only those aggregate functions of the AST which are affected by the changes to the underlying tables (**Palpanas** 3.5 Eliminate Unnecessary Operations).

"integrating said changes into said AST by computing each algebraic function" as all the necessary changes for the AST are computed based only on the

modification to the base table (and the corresponding values in the AST) (**Palpanas** 1 Introduction).

With respect to claim 15, **Palpanas** teaches **"a method of incrementally maintaining algebraic functions in automatic summary tables (ASTs) of at least one relational database, said method comprising"** as the incremental infrastructure with work areas to support the maintenance of functions that are algebraic (**Palpanas** Abstract). Materialized views, or Automatic Summary Tables (ASTs), are increasingly being used to facilitate the analysis of the large amounts of data being collected in relational databases (**Palpanas** Introduction).

"associating a work area with each algebraic function in each AST" as a function is algebraic for an operation if the new result of the function, as a result of the operation, can be computed using some small, constant size storage (work area) that accompanies the existing value of the aggregate (**Palpanas** 1.1 Classes of Aggregate Functions).

"populating variables within each work area for each algebraic function when each AST is created and when each AST is updated" as when an update is required, expressions are built in the result of the join to compute the new values of the affected aggregate functions by combining the old values from the AST with the corresponding values of the final delta (**Palpanas** 2.2.2 Apply Phase Compilation). The maintenance of algebraic functions is optimized by incrementally maintaining the information in the work area and computing the resulting aggregate function of the

query from the work area. Some standard SQL functions that are algebraic are AVG, CORRELATION, COVARIANCE, the REGRESSION functions, STDDEV and VARIANCE (**Palpanas** 4 Using Work Areas). AVG and STDDEV are algebraic for INSERT and DELETE. For AVG, the work area consists of simply the COUNT (**Palpanas** 1.1 Classes of Aggregate Functions).

"maintaining each work area by adding and subtracting to and from associated variables of each work area" as the system can compute the new value of the aggregate function from its old value and the changes themselves, for both insertions and deletions (**Palpanas** 1.1 Classes of Aggregate Functions). Examiner interprets insert as adding and delete as subtracting. **"when associated data changes in said relational database"** as the apply phase detects that only updates are in the data flow, and consequently builds clauses that update only those aggregate functions of the AST which are affected by the changes to the underlying tables (**Palpanas** 3.5 Eliminate Unnecessary Operations).

"recomputing said algebraic function after one or more of said variables have changed" as only the function STDDEV (salary) will be recomputed, since the specified changes do not affect the other aggregate functions (**Palpanas** 3.5Eliminate Unnecessary Operations, Example 3). Recomputation is being done after changes made to salary.

4. Claims 3, 10, 17 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Palpanas et al.** (NPL "Incremental Maintenance for Non-Distributive

Aggregate Functions, Proceedings of the 28th VLDB conference, Hong Kong. China, 2002, 12 pages") as applied to claims 1-2, 4, 8-9, 11, 15-16, 21-22 and 24 above, in view of **Liu et al**. (**Liu** hereinafter) (NPL "Derivation of Incremental equations for Nested Relations, Database Conference, 2001, ADC 2001, Proceedings 12th Australasian, pp. 76-82").

With respect to claim 3, **Palpanas** teaches **"the method in claim 2, wherein said multiple algebraic function share the same work area when one of"** as the work areas from each partition are then combined into a final work area, and the aggregate function is computed from the final work area. We apply the same algorithms to incrementally maintain these functions for insertions, and similar algorithms can also be used for deletions. The final work area for each of these functions must be kept in the materialized view as an additional, hidden attribute (**Palpanas** 4 Using Work Areas). The examiner interprets the final work area as shared area.

"said algebraic function" as a function is algebraic for an operation if the new result of the function, as a result of the operation, can be computed using some small, constant size storage (work area) that accompanies the existing value of the aggregate (**Palpanas** 1.1 Classes of Aggregate Functions).

Palpanas discloses the elements of claim 3 as noted above but does not explicitly teach the step of having **"exact match or partial match or an intersection."**

However, **Liu** discloses **"exact match or partial match or an intersection"** as

R be a nested relation schema and r and s be two relations over R. The intersection of r and s, denoted by r ∩ s, is a nested relation over R (**Liu** Definition 3.4). The contained difference of r and s, denoted by r [-] s, is equal to the ordinary set difference r - s if s is a subset of r (**Liu** Definition 3.9). Contained difference gives the partial match.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Liu's** teaching would have allowed **Palpanas** to provide better performance by using view maintenance algorithm (**Liu** Conclusion) which provides recursive union, difference and intersection operators.

Claims 10, 17 and 23 are same as claim 3, except claim 23 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

5. Claims 5-7, 12-14, 18-120 and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Palpanas et al**. (NPL "Incremental Maintenance for Non-Distributive Aggregate Functions, Proceedings of the 28th VLDB conference, Hong Kong. China, 2002, 12 pages") as applied to claims 1-2, 4, 8-9, 11, 15-16, 21-22 and 24 above, in view of **Martin Escardo**. (**Escardo** hereinafter) (NPL "Escardo, Martin. "Floating Point arithmetic with error analysis" May 3 2001. University of Edinburgh").

With respect to claim 5, **Palpanas** does not explicitly teach, **"the method in claim 1, further comprising estimating the error associated with said maintaining process."**

However, **Escardo** discloses **"the method in claim 1, further comprising estimating the error associated with said maintaining process"** as using floating point arithmetic is to perform error analysis (**Escardo** Paragraph 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Escardo's** teaching would have allowed **Palpanas** to obtain a bound on the error of a particular expression (**Escardo** Paragraph 1) by estimating the error associated with the incremental maintenance procedure.

Claims 12, 18 and 25 are same as claim 5, except claim 25 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

With respect to claim 6, **Palpanas** does not explicitly teach, **"the method in claim 5, wherein said error relates to floating point number computations."**

However, **Escardo** discloses **"the method in claim 5, wherein said error relates to floating point number computations"** as using floating point arithmetic is to perform error analysis (**Escardo** Paragraph 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Escardo's** teaching would have allowed **Palpanas** to obtain a bound on the error of a particular expression (**Escardo** Paragraph 1) by estimating the error associated with the incremental maintenance procedure.

Claims 13, 19 and 26 are same as claim 6, except claim 26 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

With respect to claim 7, Palpanas teaches **"variables in work areas"** as when an update is required, expressions are built in the result of the join to compute the new values of the affected aggregate functions by combining the old values from the AST with the corresponding values of the final delta (**Palpanas** 2.2.2 Apply Phase Compilation). The maintenance of algebraic functions is optimized by incrementally maintaining the information in the work area and computing the resulting aggregate function of the query from the work area. Some standard SQL functions that are algebraic are AVG, CORRELATION, COVARIANCE, the REGRESSION functions, STDDEV and VARIANCE (**Palpanas** 4 Using Work Areas). AVG and STDDEV are algebraic for INSERT and DELETE. For AVG, the work area consists of simply the COUNT (**Palpanas** 1.1 Classes of Aggregate Functions).

Palpanas discloses the elements of claim 7 as noted above but does not explicitly teach the step of having **"error variable to provide estimates of the error in said variables."**

However, **Escardo** discloses **"error variable to provide estimates of the error in said variables"** as to use the assumption that a real number *x* is approximated by the number $\hat{x}$, where $\hat{x} = x(1+\epsilon)$. In this equation, ϵ is the relative error in the representation (**Escardo** Paragraph 2). ϵ is the error variable in this equation.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Escardo's** teaching would have allowed **Palpanas** to obtain a bound on the error of a particular expression (**Escardo** Paragraph 1) by estimating the error associated with the incremental maintenance procedure.

Claims 14, 20 and 27 are same as claim 7, except claim 27 sets forth the claimed invention as a computer program, and are rejected for the same reasons as applied hereinabove.

Conclusion

6. The prior art made of record and not replied upon is considered pertinent to applicant's disclosure is listed on 892 form.

Contact Information

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Usmaan Saeed whose telephone number is (571)272-4046. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain Alam can be reached on (571)272-3978. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Usmaan Saeed
Patent Examiner
Art Unit: 2166

Hosain Alam
Supervisor

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February 16, 2006